

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS AND STATISTICS

STAT 319: Probability & Statistics for Engineers & Scientists
Semester 172
Final Exam

Please circle your instructor's name:

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Name: _____ ID #: _____ Section #: _____

- This is a multiple-choice exam consisting of 24 questions, with 4 choices each.
- There is only one correct answer.
- If you mark more than one answer to any question, that answer will be considered wrong even if the correct answer is marked.
- Duration of the exam is 2 hours.

- 1) If a histogram is skewed with a long left tail, which of the following must be correct?
 - a) The sample mean is smaller than the sample median.
 - b) The sample mean is larger than the sample median.
 - c) Some data points should be classified as outliers.
 - d) No data points should be classified as outliers.

- 2) The following data represents a sample of 13 measurements of concentration of suspended material in water.

42.4	65.7	29.8	58.7	52.1	55.8	57.0	54.3	73.1	59.9	62.2	69.9	67.9
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The percentage of concentration exceeded by 20% of the measurements is

- a) 63.74
 - b) 65.70
 - c) 67.90
 - d) 68.30

- 3) There is a 4% probability that the plane used for a commercial flight has technical problems, and this causes a delay in the flight. If there are no technical problems with the plane, then there is still a 33% probability that the flight is delayed due to all other reasons. What is the probability that the flight is delayed?
 - a) 0.370
 - b) 0.356
 - c) 0.330
 - d) 0.040

- 4) After production, an electrical circuit is given a quality score of A, B, C, or D. Over a certain period of time, 77% of the circuits were given a quality score A, 11% were given a quality score B, 7% were given a quality score C, and 5% were given a quality score D. Furthermore, it was found that 2% of the circuits given a quality score A eventually failed, and the failure rate was 10% for circuits given a quality score B, 14% for circuits given a quality score C, and 25% for circuits given a quality score D. If a circuit failed, what is the probability that it had received a quality score either C or D?
 - a) 0.0223
 - b) 0.0487
 - c) 0.2407
 - d) 0.4579

- 5) An archer hits a bull's-eye with a probability of 0.09, and the results of different attempts can be taken to be independent of each other. If the archer shoots a series of arrows, what is the probability that the *first* bull's-eye is scored with the fourth arrow?
 - a) 0.0001
 - b) 0.0007
 - c) 0.0678
 - d) 0.7536

- 6) A company receives 60% of its orders over the Internet. Within a collection of 10 independently placed orders, what is the probability that at least two orders are received over the Internet?
 - a) 0.9983
 - b) 0.0106
 - c) 0.0017
 - d) 0.0006

- 7) The time in days between breakdowns of a machine is exponentially distributed with $\lambda = 0.2$. If the machine has performed satisfactorily for six days, what is the probability that it lasts at least two more days before breaking down?
- 0.1123
 - 0.3207
 - 0.6703
 - 0.9501

- 8) Specifications call for the thickness of aluminum sheets that are to be made into cans to be between 9 and 13 thousandth of an inch. Let X be the thickness of aluminum sheets. Assume the probability density of X is given by

$$f(x) = \begin{cases} \frac{x}{100}, & 5 < x < 15 \\ 0 & \text{elsewhere} \end{cases}$$

The probability that a randomly selected sheet will **not** meet the specifications is

- 0.10
 - 0.14
 - 0.28
 - 0.72
- 9) Suppose a certain mechanical component produced by a company has a width that is normally distributed with a mean 2600 and a standard deviation 0.6. What proportion of the components have a width outside the range 2599 to 2601?
- 0.8130
 - 0.1970
 - 0.0948
 - 0.0052
- 10) The time that a technician requires to perform preventive maintenance on air conditioning unit is governed by the exponential distribution with mean time one of hour. Your company has a contract to maintain 70 of these units in an apartment building. What is the probability that the average maintenance time exceeds 75 minutes?
- 0.0000
 - 0.0183
 - 0.0813
 - 0.286

The following are two $100(1 - \alpha)\%$ confidence interval estimates of the mean of the cycles to failure of a mechanical device

$$3124.9 \leq \mu \leq 3215.7 \quad \& \quad 3079.5 \leq \mu \leq 3261.1$$

- 11) The value of the sample mean cycles to failure is equal to
- 90.10
 - 181.6
 - 3170.3
 - We need more information
- 12) If the sample size used by the second confidence interval is n , then the sample size needed to get the first confidence interval is
- n
 - $2n$
 - $4n$
 - Need to know α

13) A machine is producing metal pieces that are cylindrical in shape. A sample of pieces is taken and the diameters (in centimeters) are:

1.01 0.97 1.03 1.04 0.99 0.98 0.99 1.02 1.06

Assume the normality assumption is satisfied, then a 99% confidence interval for the mean diameter of pieces from this machine is given by:

- a) Between 0.976 and 1.043
- b) Between 0.986 and 1.033
- c) Between 0.991 and 1.028
- d) Between 1.009 and 1.010

14) In testing the null hypothesis $H_0: \mu = 10$ vs $H_1: \mu > 10$, using the rejection region $RR = \{\bar{x} > 12\}$. The probability of type II error is

- a) $P(\bar{x} \leq 12 | \mu = 11)$
- b) $P(\bar{x} > 12 | \mu = 11)$
- c) $P(\bar{x} \leq 12 | \mu = 9)$
- d) $P(\bar{x} > 12 | \mu = 9)$

15) An experimenter claims that the viscosity of a liquid detergent is supposed to average 800. A random sample of size 16 batches of detergent is collected and the average viscosity is 812, with a standard deviation of 25. The smallest level of significance at which the claim is rejected is:

- a) Between 0.0274 and 0.050
- b) Between 0.035 and 0.05
- c) Between 0.05 and 0.100
- d) Between 0.07 and 0.1

16) In an experiment to determine if two products are equally liked by consumers, a sample of 1000 randomly selected consumers found that 515 favored product A. To perform an appropriate test of hypothesis at 1% level of significance, the observed test statistic equals

- a) 0.0513
- b) 0.5000
- c) 0.5150
- d) 0.9487

A regression model was used to analyze the data from a study investigating the relationship between compressive strength (x) and intrinsic permeability (y) of various concrete mixes and cures. Summary quantities are:

$$\sum_{i=1}^{14} y_i = 572, \quad \sum_{i=1}^{14} x_i = 43, \quad S_{xx} = 25.348, \quad S_{yy} = 159.714, \quad S_{xy} = -59.057$$

Use the above information to answer the following four questions

17) If compressive strength increases by 2 units, then permeability decreases by

- a) 2.3298
- b) 4.6597
- c) 29.0418
- d) 33.7014

18) Suppose that the observed value of permeability at $x = 3.7$ is $y = 46.1$, the corresponding residual is

- a) 6.707
- b) 39.392
- c) 42.414
- d) 48.013

19) An estimate of the variance of the error is

- a) 1.3578
- b) 1.8436
- c) 4.7035
- d) 22.123

20) A 99% confidence interval estimate for the slope of the regression line is

- a) $[-2.8104, -1.8492]$
- b) $[-3.0529, -1.6067]$
- c) $[-3.1536, -1.5060]$
- d) $[-3.3897, -1.2699]$

Information from 20 houses was used to develop a regression model to predict the cost of air conditioning, y , in SR, using the variables

x_1 = daily minimum outside temperature in °F

x_2 = thickness of insulation in inches

Predictor	Coef	SE Coef	T
Constant	448.3	90.78	4.93
x_1	2.7	1.23	2.23
x_2	-15.9	10.06	-1.58

S = 40.91

Analysis of Variance

Source	DF	SS	MS	F
Regression				
Residual Error		28452.60		
Total		39395.62		

Use the above information to answer the following four questions

21) The estimated cost of air conditioning for temperature of 80°F and 0.30 inch insulation is

- a) 1170.47
- b) 659.53
- c) 529.223
- d) 187.3

22) The observed test statistic for testing the significance of the model is

- a) -2.23
- b) -1.58
- c) 3.26
- d) 4.93

23) The percentage of variation explained by the model is

- a) 10.94%
- b) 27.787%
- c) 39.39%
- d) 40.91%

24) A 95% confidence interval for the expected change in heating costs as a result of a 1°F change in the daily minimum outside temperature is

- a) Between SR0.1520 and SR5.3721
- b) Between SR5.2919 and SR37.174
- c) Between SR204.78 and SR497.17
- d) Between SR4.3860 and SR36.380